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NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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# Deer Browse Production of Oak Stands in Central Lower Michigan[1]

**ABSTRACT.—The extensive oak forests of Lower Michigan provide essential habitat for whitetailed deer and other wildlife. Clearcutting these stands results in high browse production (500-1000 lbs./acre) compared to uncut stands (200-500 lbs./acre). Most browse in uncut stands is under 18 inches tall, whereas much of that in open stands is above snowline and thus available in winter.**

Forest communities in which oaks are the dominant trees occupy approximately 30 percent of the forest area and 60 percent of the sawtimber area in the Manistee National Forest and adjacent state and private forest lands in the western half of central Lower Michigan. A few oak stands are being converted to pine; others are managed for oak. But the only management practiced in the majority of the stands is fire protection. Because of the proximity of the forest to major centers of population and the increasing pressure for hunting and other recreational activities, wildlife relationships are important. This report describes deer-habitat components of a variety of oak stands ranging from closed old-growth to recently cut and open stands. Emphasis is placed on food production for white-tailed deer.

Historical records and tree age data indicate that the areas included in our study supported pine-oak mixtures which were cut and burned between 1880 and 1900. Since then the "closed" stands of this study developed and have not been cut. Those designated as "open" stands developed after more recent cutting and burning (fig. 1).

## Methods

Seven areas, which ranged in size from 19 to 25 acres, were selected to represent a variety of ecological situations. Six of the areas were in or adjacent to the Udell Experimental Forest (Manistee County) or in the Pine River Experimental Forest (Wexford County); the seventh was in Newaygo County. Soils of the six sample areas on flat or undulating terrain can be classified in the Rubicon-Grayling Sand Plain Association; the seventh (Stand 1) on the slope of a moraine is in the Roselawn Sand Association. These soils have common characteristics: perviousness and low retention of moisture, high silicon content, acid reaction, and relatively low natural fertility.[2]

In each area the vegetation was sampled at points 30 to 40 feet apart. Plot layout was based on these points. Since a single plot size does not serve to measure all plant characteristics efficiently, especially when a variety of life forms is involved, plots of four different kinds were used as follows:

1. All woody stems greater than 1 inch d.b.h. were recorded by species and d.b.h. on plots 20 by 50 feet.
2. Leaf and stem cover (in two height categories: 18 inches to 10 feet and over 10 feet) was recorded along 50-foot line transects placed through the center of the 20x50-foot plots.
3. The number of stems from 18 inches in height to 1 inch d.b.h. were tallied in plots 3.3 feet square (¼ milacre). Within these same plots the annual growth (both stems and leaves) of all browse plants 18 inches to 6 feet in height was clipped and weighed.
4. The amount of browse from woody plants and forbs below 18 inches in height was determined by clipping and weighing material from a plot 3.3 by 1.6 feet nested in each larger 3.3-foot-square plot. Eighteen inches was chosen as the breaking point since snow depths greater than that preclude digging for low browse by deer and since a natural break in shrub height occurs at that level.

Browse was weighed in the field and results are presented as green weight. Samples of browse dried and weighed at intervals indicated that for most

1 *This study was a joint effort of the Lower Michigan National Forest, Michigan State University, and the North Central Forest Experiment Station. Field work was done by Larry Lehman and Paul Matthiae. The assistance and guidance provided by George W. Irvine are gratefully acknowledged.*

2 *Veatch, J. O. Soils and land of Michigan. Mich. State Coll. Press, 241 p. 1953.*

Figure 1.—(*Top*) Stand 1, a mixed oak stand 70 to 80 years of age in the Udell Hills near Wellston, Michigan. (*Bottom*) Stand 5, a residual mixed oak stand one year after a commercial clearcut in 1964; near Wellston, Michigan.

species dry weight was 50 percent of fresh weight. The intensity of browsing was tallied in four categories: none, light, moderate, and severe for stems within the 3.3-foot-square plots. Deer pellet groups and other animal sign were recorded when present in each 20x50-foot plot. Field work was completed during the summer of 1965; and tabulations were made, using a program for automatic data processing developed for browse production studies.[3]

## Results and Discussion

Data are presented for two stand categories: stands with essentially closed canopies, and open stands with little crown cover. Details of history, structure, species composition, and browse production are provided in tables 1, 2, and 3. The common and scientific names of plants mentioned are listed in table 4.

### Closed Stands

These three stands represent advanced stages of forest development in which oak species are the overstory dominants. Although similar in age, the stands differ considerably in structure and stocking. This may be due in part to site differences and in part to the history of the specific areas.

Well-stocked, essentially even-aged pole stands such as Stand 1 (fig. 1) are typical of those on the moraines that form the Udell Hills. These stands are dominated by white oak and red oak. Similar pole stands (Stand 2) on flat or undulating terrain with sandy, well-drained, and infertile soils differ in composition chiefly in that red maple is more abundant. The dense crown cover in these pole stands results in relatively low production of woody browse (table 3). Exceptions occur where stocking is reduced early in stand development, resulting in a partly open stand of larger trees (Stand 3). In such low-density stands with a relatively high canopy, browse production may be much greater than in the better stocked, older pole stands.

In these stands most of the browse is less than 18 inches in height and thus often below the snow line. Acorns, a supplemental food, are abundant on the ground in years of high production. Therefore, food for deer is available for consumption during the fall, late spring, or summer, but not so readily in winter. However, it is not logical to assume that woody browse above 18 inches tall is the only available winter food. If this were the case, these stands would provide meager fare indeed. In central Lower Michigan, snow depths vary greatly and in some winters low browse is extensively utilized by deer. The tree crowns provide ample summer cover. Since none of the closed stands included conifers, effective winter cover is lacking, a situation common throughout the oak type.

### Open Stands

In the open stands large quantities of browse were produced, both above and below the 18-inch level, mainly by white and red oak, black cherry, red maple, sweetfern, and blueberry (table 3).

The open communities are representative of successional stages in the early development of oak stands, following disturbance. Where oak and red

[3] *Manuscript on this automatic data processing program is in preparation at the Station.*

Table 1.—*Structure and history of the oak stands*

| Stand number and history | Age | Basal area per acre | Height of codominants | Tree stems per acre with d.b.h. of 2"-8" | Tree stems per acre with d.b.h. of 8"-18" | Crown cover above 10' | Browse per acre | Future stand type |
|---|---|---|---|---|---|---|---|---|
| | Years | Sq.ft. | Ft. | No. | No. | Percent[1/] | Pounds[2/] | |
| | | | CLOSED STANDS (no recent disturbance) | | | | | |
| 1. Well-stocked pole stand on moraine | 70-80 | 94 | 56 | 391 | 70 | 127 | 351 | Mixed oak |
| 2. Pole stand, level sandy terrain | 55-80 | 81 | 55 | 479 | 49 | 119 | 216 | Oak - red maple |
| 3. Open stand on good site | 55-65 | 50 | 80 | 48 | 42 | 69 | 575 | Mixed oak |
| | | | OPEN STANDS | | | | | |
| 4. Clearcut and burned 1935 | 24-30 | 30 | 18 | 301 | 5 | 34 | 857 | Open - mixed oak |
| 5. Clearcut 1964-65 | 1 | 26 | 1-2 | 299 | 4 | 36 | 535 | Mixed oak |
| 6. Clearcut 1962 | 3 | 24 | 3-8 | 188 | 0 | 20 | 976 | Oak - red maple |
| 7. Overstory cut 1955 | 10 | 29 | 4-10 | 256 | 7 | 37 | 863 | Oak - red maple |

1/ Percentage of line transect occupied. 2/ Green weight including stems and leaves of high and low browse.

Table 2.—*Crown cover expressed as a percentage of line transect occupied*

| Species | High cover--over 10 feet: Closed stands 1 | 2 | 3 | Open stands 4 | 5 | 6 | 7 | Low cover--18 inches or less: Closed stands 1 | 2 | 3 | Open stands 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White oak | 28 | 31 | 26 | 18 | 15 | 4 | 14 | 4 | 4 | 4 | 14 | 4 | 6 | 11 |
| No. red oak | 59 | 39 | 21 | 2 | 9 | 1 | 5 | 7 | 4 | 1 | 2 | 1 | 3 | 1 |
| No. pin oak | 19 | 7 | 16 | 3 | 4 | 1 | - | - | (1/) | (1/) | 2 | (1/) | 1 | - |
| Red maple | 17 | 36 | 2 | 2 | 7 | 12 | 15 | 4 | 10 | 1 | 1 | 7 | 3 | 8 |
| Black cherry | - | 1 | - | 8 | - | (1/) | - | - | 1 | - | 7 | (1/) | (1/) | - |
| Bigtooth aspen | 4 | 5 | 3 | 1 | - | 1 | 3 | (1/) | (1/) | - | - | (1/) | 8 | (1/) |
| Juneberry | - | - | - | - | (1/) | 1 | - | - | 2 | - | - | 1 | (1/) | 2 |
| Sassafras | - | - | 1 | - | - | - | - | 1 | 1 | 1 | - | (1/) | (1/) | (1/) |
| Witchhazel | - | - | - | - | 1 | - | - | 9 | - | 4 | - | 1 | - | - |
| Total | 127[4/] | 119[4/] | 69 | 34 | 36 | 20 | 37 | 26[2/] | 22 | 13[3/] | 26 | 14 | 21 | 22 |

1/ Trace. 2/ Includes 1% blueberry. 3/ Includes 2% huckleberry and traces of blueberry and sweetfern. 4/ Cover over 100 percent results when several layers are present.

Table 3.—*Browse production presented as green weight of stems and leaves (Pounds per acre)*

| Species | Browse under 18 inches: Closed stands 1 | 2 | 3 | Open stands 4 | 5 | 6 | 7 | Browse 18 inches to 6 feet[1/]: Closed stands 1 | 2 | 3 | Open stands 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White oak | 1 | 14 | 1 | 4 | 175 | 22 | 83 | - | 2 | - | 102 | 49 | 257 | 147 |
| No. red oak | 9 | 6 | - | - | 12 | 17 | 41 | - | 17 | 21 | - | 33 | 233 | 3 |
| No. pin oak | 1 | 1 | 18 | (2/) | 1 | - | - | 2 | - | - | 79 | - | - | - |
| Red maple | 6 | 3 | 6 | - | 6 | (2/) | 14 | 13 | 20 | - | 5 | 40 | 9 | 97 |
| Black cherry | (2/) | 1 | - | 21 | 5 | 58 | 5 | - | 2 | - | 40 | 9 | 30 | - |
| Bigtooth aspen | - | - | - | 1 | - | 17 | - | - | - | - | - | 1 | 129 | - |
| Juneberry | - | 2 | (2/) | - | 8 | 3 | 9 | - | 1 | - | - | 13 | - | - |
| Sassafras | 44 | 55 | 8 | - | 55 | 3 | 14 | 13 | 10 | 1 | - | - | - | 3 |
| Sweetfern | - | 80 | 59 | 289 | 31 | 140 | 280 | - | 6 | (2/) | - | - | - | 2 |
| Blueberry | 184 | 14 | 322 | 316 | 65 | 52 | 160 | 22 | - | - | - | - | - | - |
| Huckleberry | 11 | - | 102 | - | - | - | - | 2 | - | 31 | - | - | - | - |
| Wintergreen | 14 | 2 | 3 | (2/) | 1 | 6 | 5 | - | - | - | - | - | - | - |
| Witchhazel | - | - | 3 | - | - | - | - | 29 | - | - | - | 32 | - | - |
| Total | 270 | 178 | 522 | 631 | 359 | 318 | 611 | 81 | 58 | 53 | 226 | 177 | 658 | 252 |

1/ Woody stem material alone averages 15 percent of the total and ranges from 10 to 20 percent.
2/ Trace.

Table 4.--Common and scientific names of trees, shrubs, and herbs mentioned in this report

| Common name | Scientific name |
|---|---|
| | TREES |
| Bigtooth aspen | Populus grandidentata Michx. |
| Black cherry | Prunus serotina Ehrh. |
| Juneberry | Amelanchier spp. |
| Red maple | Acer rubrum L. |
| White oak | Quercus alba L. |
| Northern red oak | Q. rubra L. |
| Northern pin oak | Q. ellipsoidalis E. J. Hill |
| Sassafras | Sassafras albidum (Nutt.) Nees |
| | SHRUBS AND HERBS |
| Blueberry | Vaccinium angustifolium Ait. |
| Honeysuckle | Lonicera spp. |
| Huckleberry | Gaylussacia baccata (Wang. ) K.Koch |
| Sweetfern | Myrica asplenifolia L. |
| Witchhazel | Hamamelis virginiana L. |
| Wintergreen | Gaultheria procumbens L. |

maple stands have been cut or burned, most tree reproduction will develop as clumps of sprouts from the cut stumps and from severed saplings. Generally, in commercial cuts (Stands 5, 6, and 7) a few pole-size oak and red maple remain, but these trees do not interfere with rapid development of sprout clumps and browse (tables 2 and 3, fig. 1).

Browse production begins to increase the first growing season after cutting, and this increase continues for several years. The stump sprouts grow rapidly, and their contribution to browse production will decrease as the stems grow out of reach, perhaps by the end of the fifth or sixth year. Low-browse production will continue heavy as long as enough light is available for growth. In these oak stands a closed canopy appears to develop slowly (table 2) especially where logging was followed by fire (Stand 4); and hence a high level of browse production is maintained for as many as 20 or 30 years (table 3).

### Amount of Browsing

In both open and closed stands the amount of browsing is influenced both by the quantity of material present and by the proximity of areas of coniferous cover in which deer might winter. In most stands oak species, blueberry, sweetfern, and sassafras were lightly or moderately browsed while red maple and aspen were heavily browsed. Browsing pressure in a few areas such as Stand 4 may be heavy enough to retard the development of tree regeneration, thus keeping the stand open.

### Variability of Data

Browse production on individual plots varied widely. For tall-browse samples (including both stem and leaves) obtained on ¼-milacre plots, the standard error of the mean averaged 44 percent of the mean for closed stands and 39 percent of the mean for open stands (range from 33 to 59 percent). In samples of low browse on ⅛-milacre plots the average standard error of the mean was 24 percent of the mean in closed stands and 26 percent in open stands (range 16 to 39 percent). Considering the clumped distribution of stump sprouts and of shrub stems in particular, this variability does not appear excessive.

## Conclusion

The production of browse for deer is an important phase of multiple-use management in the oak stands of the Manistee National Forest and adjacent areas. Our data and observations suggest that clearcut areas often provide large quantities of food. Full utilization of this browse depends upon such factors as cover and snow depth. Blocks of conifers for winter cover could extend the period of use of the browse. At present most browsing amounts to a light thinning of the sprout clumps and has not greatly affected the growth of the oaks and red maple which will be the dominant species of the new stands.

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